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ABSTRACT

A two-year behavior-modeling training program focusing on attention processes, retention processes, motor reproduction, and motivation processes was implemented to increase the accuracy of free throw shooting for a varsity intercollegiate women's basketball team. The training included specific learning keys, progressive relaxation, mental rehearsal, and goal setting. A multiple baseline design was used to evaluate the effectiveness of this training technique. The autoregressive integrated moving averages modeling technique (Box & Jenkins, 1976) indicated that the error terms for the data from both years of the program were not serially correlated, thus suggesting the appropriateness of a repeated measures analysis of variance (ANOVA). The results of the ANOVA indicated that the training program was effective in improving free throw shooting. The data also suggest that goal setting is an effective technique for maintaining performance improvement over an extended period of time. (Author)

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INCREASING FREE THROW ACCURACY THROUGH BEHAVIOR MODELING AND GOAL SETTING

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ABSTRACT

A two-year behavior-modeling training program focusing on attention processes, retention processes, motor reproduction, and motivation processes was implemented to increase the accuracy of free throw shooting for a varsity intercollegiate women's basketball team. The training included specific learning keys, progressive relaxation, mental rehearsal, and goal setting. A multiple baseline design was used to evaluate the effectiveness of this training technique. The autoregressive integrated moving averages modeling technique (Box & Jenkins, 1976) indicated that the error terms for the data from both years of the program were not serially correlated, thus suggesting the appropriateness of a repeated measures analysis of variance (ANOVA). The results of the ANOVA indicated that the training program was effective in improving free throw shooting. The data also suggest that goal setting is an effective technique for maintaining performance improvement over an extended period of time.

INCREASING FREE THROW ACCURACY THROUGH BEHAVIOR MODELING AND GOAL SETTING

A behavior modeling free-throw training program was implemented for a varsity intercollegiate women's basketball team in the Fall of 1985 (Bandura, 1977; Davis & Mount, 1984; Meyer & Raich, 1983). The effectiveness of the first year training program led to a similar program the following year. This report describes the training programs, the motivation techniques used to enhance player interest, and the evaluation of the programs over the 2-year period.

Behavior modeling consists of four basic components:
(1) Attention Processes - The learner must attend to the appropriate aspects of the desired behavior. Key learning points were identified, emphasized, and modeled via video tape to assist the learner in attending to the appropriate aspects of free throw shooting.

(2) Retention Processes - The learner must organize the information to be retained for later performance in such a manner that it can be quickly retrieved and used to guide performance. Mental rehearsal, the process in which an individual visualizes herself performing the behavior previously seen performed by the model, is an important aspect of the retention process since the learner may not be able to physically practice the behavior at the time of observing the model (Decker, 1980; Feltz & Landers, 1983).

(3) Motor Reproduction - The learner must also physically practice the behavior that is being learned (Decker & Nathan, 1985).

(4) Motivation Processes - In addition to having the ability to perform, the learner must have the desire to perform (Decker & Nathan, 1985). Performance feedback and goal setting are effective means of motivating individuals to direct effort toward certain behaviors (Erez, 1977; Locke, Shaw, Saari, & Latham, 1981; Wexley & Baldwin, 1985).

The objective of this study was to evaluate the effectiveness of applying these principles to improve the skill of free throw shooting. In addition, progressive relaxation training was incorporated into the program to teach the players to control their level of arousal and to regain their composure and concentration on demand.

METHOD

The first year training program consisted of five phases, Baseline, Relaxation Training, Behavior Modeling/Mental Rehearsal Training, Goal Setting, and Reversal. The training was identical the second year with two exceptions. During the second year (a) Relaxation and Behavior Modeling/Mental Rehearsal were combined and (b) goal setting was continued during the final phase, which is referred to as Maintenance.

Subjects. All members of a intercollegiate varsity women's basketball team participated in the training program. The first year involved 14 players. Four players graduated, 1 resigned, and 3 freshmen joined the team resulting in 12 players the second year.

Design

A multiple baseline design was used to implement and evaluate the training. Each year the team was divided into three groups: seniors, juniors and sophomores, and freshmen. Although the groups started the training at staggered intervals, every group went through each phase of the training in the same sequence. The training took place over a six-week period. Each week day throughout this time period and until the start of regular season play, each player shot two sets of ten free throws regardless of the phase of training.

Baseline. The baseline period consisted of the time before training was implemented and provided a "pre-training" measure of free-throw performance. A minimum of eight sets of ten free throws were recorded for each player during this period. It should be noted that 9 of the 12 players involved the second year of the program had been through the training the previous year. Thus, the second year baseline period was not truly "pre-training" for these players.

Relaxation Training. Each player was taught a progressive relaxation technique (Jacobson, 1938) in which they first tensed then relaxed eleven different muscle groups. This technique takes about 25 minutes to complete. Each player also learned a shortened version of muscle relaxation that reduces the eleven muscle groups to four groups and takes less than 5 minutes to complete. Both forms of relaxation were practiced during training sessions.

Behavior Modeling/Mental Rehearsal. The behavior modeling portion of the training began by instructing the players on four learning keys for free-throw shooting: (1) Balance. (2) Eyes on target. (3) Elbows in. (4) Follow through. Following this

review, players practiced the shortened relaxation technique then viewed a video tape of a player shooting and making ten consecutive free throws (Hall & Erffmeyer, 1983; Suinn, 1979). Each player then closed her eyes and visualized herself shooting and making a perfect free-throw. This sequence was repeated ten times during each of the training sessions. Players were instructed to use this technique to practice free-throw shooting.

Goal Setting. For three weeks following completion of mental rehearsal training, a challenging but realistic goal was set for each player for her free-throw shooting that week. Goals were based on the player's performance in the earlier phases of the training. Group goals were determined by averaging the individual goals for all group members. Group performance was recorded daily on charts posted in the dressing room.

At the beginning of each week, players were given individual and group feedback in terms of their free-throw percentage and how this compared to their weekly goal. Following the feedback, goals were set for the current week.

Reversal Phase (1st Year)/Maintenance Phase (2nd Year). Following the six-week training program, the team continued to shoot and record sets of ten free throws on a regular basis until the start of regular season play. During the first year of the training program no goals were set for the players and the players received no feedback during this phase. However, during the second year of training, individual weekly goals were set and feedback was given to each player during this phase.

RESULTS

Manipulation Check. Questionnaire data and observational data confirmed that the players were using mental rehearsal when shooting free throws (4.42 mean response on a 5-point frequency scale) and were attending to the feedback relative to their individual and group goals.

Dependent Variable. The dependent variable was the percent of free throws made of the set of ten shots taken twice daily throughout the study.

Analysis of the First Year Training Data. Conventional ordinary least squares statistical methods are inappropriate for analyzing time-series data if the error terms are serially correlated (autocorrelated) (Cook & Campbell, 1979). The autoregressive integrated moving averages modeling technique (ARIMA) (Box & Jenkins, 1976; SAS Institute, 1980) for interrupted time-series analysis did not reveal any significant autoregressive or moving average component. It was concluded that the error terms were uncorrelated with each other.

A repeated measures analysis of variance with blocking on groups was used since the errors were independent (Appendix A). The result was a significant main effect for the phase of the program ($F(4, 752) = 10.5$, $p<.001$). Duncan's multiple range test indicated that the means for Baseline ($\bar{X} = 79.4$) and Reversal ($\bar{X} = 80.5$) were significantly different from the mean for Behavior Modeling ($\bar{X} = 82.9$) and the mean for Goal Setting ($\bar{X} = 87.6$). Performance during Relaxation ($\bar{X} = 81.2$) did not differ significantly from Baseline or Behavior Modeling. Shooting performance during the Goal Setting phase was significantly better than during any other phase (see Table 1).

There was also a main effect for Training Group ($F(2, 752) = 22.17$, $p<.001$). Seniors ($\bar{X}=87.1$) significantly out performed the Sophomores and Juniors ($\bar{X}=79.8$) and the Freshmen ($\bar{X}=81.1$). The interaction was not significant. However, there were large individual differences between players as indicated by the significant Player Within Training Group effect ($F(11, 752) = 14.02$, $p<.001$).

Analysis of the Second Year Training Data. ARIMA analysis indicated uncorrelated errors for the data for the second year. Accordingly, a repeated measures analysis of variance with blocking on groups was used to investigate the data (see Appendix A). The result was a significant main effect for the phase of the program (F (3, 792 = 9.37, $p<.01$). Duncan's Multiple Range Test indicated that the mean for Baseline ($\bar{X} = 82.1$) was significantly different from the Goal Setting ($\bar{X} = 86.9$) mean and the mean for the Maintenance Phase ($\bar{X} = 86.2$). The mean level of performance during Behavior Modeling ($\bar{X}=84.1$) did not differ significantly from any other phase.

The main effect for Training Group failed to reach significance. There was, however, a significant Training Group X Phase interaction ($F(6, 792) = 2.44$, $p<.05$). Inspection of Table 1 reveals that the Freshmen showed improvement during the Behavior Modeling Phase which was maintained throughout the program. The Sophomores, Juniors, and Seniors began their second year of the program at a higher level than the Freshmen. They increased their free-throw accuracy during the Goal Setting Phase and maintained this level during the Maintenance Phase. As in the first year, there were large individual differences between players as indicated by the significant Player Within Training Group effect ($F(9, 792) = 15.04$, $p<.001$).

Post-Training Measures. Individual player's game free throw averages for the season following both years of the training program were correlated with the respective individual averages

for the Baseline Phase, the Behavior Modeling (Training) Phase, and the Goal Setting Phase (See Appendix B). Only the correlation between the Training Phase and the season average reached significance (r =.46, p<.01, n=25).

The team's free throw percentage for games following the first year's training program was 73.6%, which is 3.3% higher than the team's percentage of 70.3% the previous year. This improvement moved the team from a national rank of 25th for the 1984-85 season to a national rank of 5th for the 1985-86 season. However, the team's free throw percentage for the season following the second year's training program (1986-87) was 67.6%. This represents a decline of 6%, which was enough to knock the team out of the national rankings. This decline is largely due to loosing a class of seniors from the '85-'86 season who were better free-throw shooters (season average 76.5%) than the group of freshmen (season average 56.5%) that replaced them. Inspection of data from the other players, who participated in both years of the training, revealed an average increase in game performance of 2.69% (SD=11.45), which is not a significant change (t (8) = .70, p>.05).

DISCUSSION

Behavior modeling incorporates many of the established principles of other behavior improvement techniques such as Visuo-Motor Behavior Rehearsal (Suinn, 1979) and social learning (Bandura, 1977). These data indicate that behavior modeling training is an effective means for improving free-throw shooting. During the first year of the program there was significant improvement from Baseline performance to performance during the Training Phase and another significant increase during the Goal Setting Phase, when performance reached its highest level. Performance during the second year of the program showed a similar pattern for the Freshmen. Their performance during the training phase showed significant improvement that was maintained throughout the program. The second year performance of the Sophomores, Juniors, and Seniors, on the other hand, began at a higher level than the Freshmen and increased to its highest level during the Goal Setting Phase. These data suggest that the behavior modeling is effective for improving free throw performance and that the upperclassmen retained the training from the first year.

These data also indicate that goal setting is an effective technique for maintaining behavioral improvement. This is consistent with the large body of research that suggests that goal setting is an effective technique for directing effort (Locke, et. al, 1980). During the reversal phase of the first year of this study free throw performance dropped back to baseline level. However, during the second year of the program

when goal setting and feedback were continued through the reversal phase, the performance improvement was maintained. This represents one of the first empirical investigations of the effectiveness of goal setting for maintaining improvements in behavior for an extended period of time (Wexley & Baldwin, 1985). This conclusion must be tempered by the fact that the present quasi-experimental design did not include a no-treatment control group, which is critical to rule out history and maturation in the evaluation of the temporal persistence of the training effect (Cook & Campbell, 1979).

Probably the most critical aspect of this training is the transfer of improved performance from training to game situations. The data from this study suggest that there is a relationship between performance during training and during season play. However, transfer is an area that deserves more attention. Goal setting and feedback proved to be very effective means for directing effort toward shooting accurate free throws during the training program. Given that the player has the requisite skill to shoot free throws, it is likely that individual performance goals and feedback for free throw shooting would be an effective means for enhancing game performance.

One of the limitations of a quasi-experimental design is the inability to make causal inferences. Thus, the external validity of the training program is difficult to evaluate with the current research design. Even analyses of individual performance have no basis for inferring a causal training effect. This is a problem that needs to be addressed in future research through more rigorous experimental design. However, the small sample size, typical of many sports teams, further exacerbates the design problem.

Another important issue is identifying sound criterion measures with which to evaluate external validity. Individual performance measures typically are available. However, these measures are contaminated somewhat by the complex, dynamic nature of game situations. Outcome measures, i.e., measures that reflect the effectiveness of the team as a unit (e.g., the team's season performance), have even more inherent short comings: not only does the situation vary from game to game but the players change from year to year as well. The criterion issue warrants attention in future research efforts.

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TABLE 1. AVERAGE FREE THROW PERCENTAGE BY GROUP BY PHASE OF THE PROGRAM

FIRST YEAR PROGRAM

PHASE: Mean / SD / (N) / GROUP	Baseline	Relaxation	B. Model.	Goal-Setting	Reversal
Team	79.4	81.1	82.9	87.5	80.0
	13.8	14.2	12.3	10.5	12.1
	(240)	(120)	(96)	(212)	(110)
Freshmen	79.4	82.5	81.2	86.8	79.0
	13.6	14.5	9.9	11.7	14.6
	(96)	(32)	(24)	(32)	(32)
Sophomores & Juniors	76.4	75.6	80.6	86.3	78.5
	14.2	14.8	13.1	10.6	10.6
	(96)	(48)	(48)	(84)	(47)
Seniors	85.2	86.7	89.1	88.9	83.2
	12.0	10.4	11.0	9.9	11.3
	(48)	(40)	(24)	(96)	(31)

SECOND YEAR PROGRAM

PHASE: Mean / SD / (N) / GROUP	Baseline	Relaxation/ B. Modeling	Goal-Setting	Maintenance
Team	82.1	84.1	86.9	86.2
	12.6	12.8	10.7	10.2
	(258)	(86)	(208)	(288)
Freshmen	79.5	87.5	86.7	87.5
	13.1	12.2	15.7	9.1
	(91)	(24)	(24)	(72)
Sophomores & Junior	84.9	83.1	87.0	86.5
	11.5	12.0	10.7	10.1
	(88)	(32)	(64)	(96)
Seniors	82.0	82.3	87.0	85.2
	12.8	14.0	9.4	10.8
	(79)	(30)	(120)	(120)

APPENDIX A

ANOVA SUMMARY TABLE FOR THE FIRST YEAR OF TRAINING

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
TRAINING GROUP	59.861	2	29.930	22.17	.000
PHASE	56.718	4	14.179	10.50	.000
TRAINING GROUP X PHASE	16.896	8	2.112	1.56	.1317
PLAYER WITHIN GROUP	154.314	11	14.028	10.39	.000
RESIDUAL	1015.064	752	1.349		

ANOVA SUMMARY TABLE FOR THE SECOND YEAR OF TRAINING

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
TRAINING GROUP	.65	2	.32	.29	.748
PHASE	31.28	3	10.43	9.37	.000
TRAINING GROUP X PHASE	16.28	6	2.71	2.44	.024
PLAYER WITHIN GROUP	150.62	9	16.74	15.04	.000
RESIDUAL	881.18	792	1.11		

APPENDIX B

CORRELATIONS BETWEEN AVERAGE BASELINE, BEHAVIOR MODELING TRAINING, GOAL SETTING, AND SEASON FREE THROW PERFORMANCE

BOTH YEARS COMBINED

Correlations:	B	T	G	S
B	1.0000	.6626**	.6221**	.4224
T	.6626**	1.0000	.6603**	.4639*
G	.6221**	.6603**	1.0000	.3136
S	.4224	.4639*	.3136	1.0000

N of cases: 25 1-tailed Signif: * - .01 ** - .001

1985-1986

Correlations:	B	T	G	S
B	1.0000	.6616*	.4288	.4572
T	.6616*	1.0000	.6916*	.5106
G	.4288	.6916*	1.0000	.1782
S	.4572	.5106	.1782	1.0000

N of cases: 13 1-tailed Signif: * - .01 ** - .001

1986-1987

Correlations:	B	T	G	S
B	1.0000	.7323*	.8386**	.4918
T	.7323*	1.0000	.6395	.4184
G	.8386**	.6395	1.0000	.3994
S	.4918	.4184	.3994	1.0000

N of cases: 12 1-tailed Signif: * - .01 ** - .001

Note: B = BASELINE PHASE
T = BEHAVIOR MODELING/MENTAL REHEARSAL TRAINING PHASE
G = GOAL SETTING PHASE
S = SEASON